period variables, δ Libræ, δ Cephei, β Lyræ, η Aquilæ, and ζ Geminorum.

THE TOTAL SOLAR ECLIPSE OF MAY.—The central line in the eclipse of May 17 passes near to Teheran, in which longitude the duration of totality will be within five seconds of the maximum. Taking the position of the Indo-European Telegraph Station in longitude 3h. 25m. 41·7s. east of Greenwich, and latitude 35° 41′ 7″, as determined by the Russian General Stebnitsky, it appears that the central line will pass between nine and ten English miles south of the station. At Shanghai, the eclipse is partial, magnitude 0·996 at 5h. 21m. p.m. local mean time: the central line runs some fifteen or sixteen miles north of that place: the sun at an altitude of 17°. At the observatory of Zi-ka-Wei, the eclipse is also partial, magnitude 0·994. In Cairo, upwards of nine-tenths of the sun's diameter are covered.

GALLE'S METHOD FOR SOLAR PARALLAX.—The present year will afford two favourable opportunities of applying the method suggested by Prof. Galle for determining the sun's parallax, viz. the observation at distant stations of the minor planets when they approach near the earth. Mr. Gill has taken steps to secure such observations about the opposition of *Victoria* on August 24, and that of *Sappho* a month later. In the case of the former, the distance from the earth at opposition will be 0·891 (the earth's mean distance being taken as unity), the declination 8° N., and the magnitude 8·3; in the latter case the distance will be 0·847, the declination 12½° N., and the magnitude 9·2. Ephemerides of both planets about opposition will be found in the *Berliner Astronomisches Jahrbuch* for 1883.

THE TEMPLE OBSERVATORY, RUGBY.—We have received the Report of this Observatory for the year 1881. As in former years, the principal instrument, an 8¼ inch refractor by Alvan Clark, has been employed on observations of double stars, and 210 complete sets of measures of distance and position were made in the past year. Mr. Seabroke, the honorary curator, with the assistance of Mr. Hodges, has completed a summary of the work in the three years 1878-80, which forms part of vol. xlvi. of the *Memoirs* of the Royal Astronomical Society recently issued. Some attention has been given to the determination of the motion of approach or recession of stars, though with the double-star work and the hour each fine evening, through part of the year, devoted to members of the school, little time remains for that class of observation, more especially as the observers engaged follow their ordinary vocations during the day, and very late hours are thus precluded.

GEOGRAPHICAL NOTES

THE mail from India brings the news of the death of a very meritorious Indian servant, and one of the most remarkable of living travellers—Nain Singh, or the Pundit No. 9, as he was officially known, a hillman of the Khsettriya, or warrior caste. Nearly thirty years ago he offered his services as native assistant to that intrepid but unfortunate explorer Herr Schlagentweit. In the year 1863 he became one of the staff of trained native explorers under the orders of Col. Montgomerie of the Trigonometrical Survey, and it was in this capacity that he earned his reputation. The experience which Nain Singh had acquired with Herr Schlagentweit was held peculiarly to fit him for employment in the most interesting department of Indian geographical research—the exploration of the Trans-Himalayan regions. The success which attended his journeys beyond the great northern mountain barrier of India exceeded the expectations of even the talented officer who had specially trained him for the work. In 1866 he determined the true position of Lhasa; in 1867 he visited the celebrated gold mines of Thok Jalung, and seven years later he began his most celebrated tour of all, that through Thibet from west to east. During this he visited the capital of the Dalai Lama, took numerous observations, and threw much fresh light on the question of the Sanpu River, and whether its lower course is the Brahmapootra or not. This exploit closed Nain Singh's public career. He was awarded the Royal medal by the Royal Geographical Society, and the Indian Government granted him a small estate, where he died towards the end of last January. There have been few native Indian officials who have done more useful or more durable service than the explorer Nain Singh.

AT the meeting of the Geographical Society on Monday Mr. D. W. Freshfield, the secretary, read a paper on a three months' journey in the Makua and Lomwe countries, by Mr. H. E. O'Neill, who succeeded the late Commander Musters as consul at Mozambique. Mr. O'Neill evidently made a very successful journey of 600 miles through country previously almost unknown, and his paper forms a contribution to geography which is of some importance, though it hardly comes up to our ideas of what a good geographical paper should be. The most telling part of it is that which deals with the manners and customs, &c., of the Makua race. Though it has been reported that Mr. O'Neill actually sighted the Wamuli Peak, said by the natives to be covered with perpetual snow, he himself distinctly says that, although its position was pointed out to him, he could not clearly distinguish it. To some future traveller, therefore, will fall the honour of actually being the first to *see* the snow-clad peak, if it really exists, though no doubt he will have been very nearly run by Mr. Maples on one side and Mr. O'Neill on the other. Towards the conclusion of his paper, Mr. O'Neill makes some useful observations on the commercial capabilities of the country traversed, from which it would appear that there is a good opening there for imports, but the economic products are at present few.

THE most important contribution in the March number of the Geographical Society's *Proceedings* is Mr. Last's account of his journey from Mamboia into the Nguru country, East Central Africa. On this occasion Mr. Last had his wife with him, and travelled, in a little over three weeks, some 250 miles, of which the whole of the region between Mguru and Kibauti was new to Europeans. Mr. Last sent home a rough map of his journey, on which he also laid down the roads and places passed in 1880, as most of them are not shown on previous maps of East Africa, and from this a map on the scale of nearly twelve miles to the inch has been prepared. There is an interesting note referring to Diego Garcia, the most southerly island of the Chagos Archipelago, and others on Mr. Colquhoun's expedition through Southern China and Burmah, and the journey of MM. Bouvalot and Capus from Bokhara to Krasnovodsk. The full text is also given of Lieut. A. W. Greely's report on the proceedings of the expedition to Fort Conger, Grinnell Land, the name he has given to the first of the international meteorological observatories in the Polar area.

THE Geographical Society have now ready for issue by Mr. Murray, Mr. E. Colborne Baber's "Travels and Researches in Western China," forming the first part of their *Supplementary Papers*, a publication which is to take the place of their annual *Journal*. The staple of the volume consists of Mr. Baber's journey of exploration in Western Szechuen, accompanied by various scientific observations and tables of latitudes and longitudes of numerous positions. The remainder of the volume contains reprints of a brief narrative of a journey to Ta-chien-tu, and notes on the route of the Grosvenor mission through Western Yünnan and on the Chinese tea-trade with Tibet. The maps are of great value, and consist of one showing the distribution of the Sifan tribes, a section of country along Mr. Baber's routes, and a large route-map of his explorations in Western China.

THE two last numbers of the *Izvestia* of the Russian Geographical Society contain a good deal of valuable information. M. Pevtsoff contributes a paper on his journeys in Mongolia, from the Altai to Kobdo, Kukukhoto, Kalgan, and back, *viâ* Urga and Ulasutai, with a map of the country; Dr. A. Woeikoff gives a *résumé* of the amount of cloud, observed during ten years' observations in Russian meteorological stations; A. E. Regel contributes a paper on his journey to Turfan in 1879; Lieut. Kalitin gives a description of the region explored between Akhalteke and Khiva, with a map; and MM. Yadrintseff gives an interesting account of the Tartars of Altai. There are, besides, a letter of A. W. Adrianoff, on his expedition in the Kuznetsk region, a list of heights determined by M. Potanin in Mongolia, information about the expedition of the *Jeannette*, of the *Alliance*, of the *Thomas Corvin*, and other small notices.

THE Russian Geographical Society is taking part in an expedition to Central Africa, under the leadership of M. Schultze-Ragozinsky, and with the participation of M. Bianchi, Prof. Licati, M. Budilovitch, of the Russian navy, M. Bartoshevitch, of the St. Petersburg University, M. Tomsen, Windakovitch, and several others. The expedition proposes to explore the little-known parts of Equatorial Africa, between 1° and 10° N. lat., and 10° to 12° E. long. The expenses will be defrayed

from a special fund subscribed by the members of the expedition, and amounting to 10,000*l.*

WITH the beginning of the present year the Geographical Society of Paris have begun to issue a fortnightly *Compte Rendu* of their proceedings, published within ten days after their meetings. A quarterly volume will also be issued containing memoirs and other papers of some length. This is a great improvement on the old *Bulletin*, which was often months behind date. The Society now numbers upwards of 2150 members.

WE may remind our readers that Mr. Edmund O'Donovan, so well known as the *Daily News* correspondent in the Trans-Caspian region, and more particularly at Merv, will read a paper before the Geographical Society, on March 27, on the geography of Merv and the surrounding country. The meeting will, we believe, be held as usual in the theatre of London University, at Burlington House.

AT the last meeting of the Geographical Society of Paris, M. Achille Raffray, Vice-Consul at Massowah, read an interesting paper on his journey in Abyssinia, and in the country of the Raya Gallas. It was announced during the evening, that one of the Society's gold medals had been awarded to M. G. Revoil, for his journeys in Somali-land, and another to Dr. Lenz, for his recent journey to Timbuktoo, the Logerdt prize medal to Dr. Montano, for his explorations in the Malayan Archipelago, and the new Jomard prize to Prof. Gaffarel, for his services in the cause of historical geography.

DIRECT news from Lieut. Bove, the leader of the Italian Antarctic expedition which started from Buenos Ayres, has been received in Italy. The expedition was most hospitably received at Buenos Ayres. The Government of the Argentine Republic has sent out a commission with the Italian Expedition for the purpose of carefully revising the survey of the coast of their country; thus the expedition now consists of four ships, viz. *Santa Cruz*, *Uruguay*, *Cape Horn*, and a steam barque. The *Cape Horn* is the largest vessel, and will proceed to the Antarctic regions, while the *Uruguay* will remain at Cape Horn. The *Santa Cruz* will attend to the coast survey. The expedition started on November 8, and Lieut. Bove hoped to leave Cape Horn by the end of December in order to sail across to South Shetland and Grahamsland. He hoped to be back at Tierra del Fuego by the end of March, to stay there till May, and then to leave for Buenos Ayres.

ON THE ELECTROLYSIS OF SULPHATE OF COPPER[1]

THE immediate object of this research was to examine various conditions connected with the transmission of electric currents through solutions of salts of copper, and to ascertain the influence of those conditions on the electro-chemical equivalent of copper, also to observe for any signs of conduction of electric currents by such liquids without electrolysis. In many of the experiments some difficulty was experienced in ascertaining the exact loss of weight of the anode, in consequence of finely-divided copper falling from it. The powder which fell off, exposing as it did a large surface to the liquid, was somewhat oxidised, and also in acid solutions freely dissolved, and its true weight, and therefore the exact loss of the anode could not be found.

Amongst the results obtained were the following:—that a porous partition in a solution of sulphate of copper affected the deposit only by preventing the products set free at the two electrodes becoming mixed together; a large surface of cathode diminished the amount of deposited metal, by allowing more copper to be re-dissolved by ordinary chemical action; the effect of diluting the liquid with sulphuric acid was to slightly diminish the amount of deposited copper; diluting the solution either with water, glycerine, propionic acid, solution of sulphate of sodium, borax, boracic acid, or of ammonic alum, had very little effect (and that variable) upon the amount of deposit; much less copper is deposited per unit of current in a hot liquid than in a cold one; without the influence of an electric current, a copper plate dissolved fifty-six times faster in an ordinary depositing solution of sulphate of copper at 180° F. than at 50 F.; the amount of copper deposited by aid of a current in such a liquid at 50° F. was about 18 per cent. greater than at 180° F.; with an electric current of small density, and a sufficiently corrosive liquid containing a very small amount of dissolved copper, no deposition of copper takes place; instead of an electric current protecting a copper cathode from chemical corrosion, it indirectly increases that corrosion; a sufficient rise of temperature (viz. from 50 F. to 180° F.) was nearly twice as influential as the electric current in increasing purely chemical corrosion; the purely chemical corrosion of a copper anode in ordinary sulphate of copper-depositing solution, is less than that of a separate piece of copper without a current; the loss of the anode is greater than the gain of the cathode in nearly every instance, and this difference is slightly greater with near electrodes than with distant ones; reduction of temperature is a most influential circumstance in diminishing the chemical corrosion of the two electrodes, and making their alterations of weight, by electrolytic action, approximate to each other; purely chemical corrosion of the copper is not entirely prevented by using a pure and cold solution not containing any free acid; the inequalities of loss and gain of the two electrodes are largely, if not wholly, due to purely chemical action; there exist relative degrees of chemical corrosive power and strength of current, at which the influence of the two are equal, and a copper cathode neither dissolves nor receives a deposit in an acidulated solution of sulphate of copper containing a very small amount of dissolved copper salt; the amount of copper deposited is not sensibly affected by the presence of a small amount of green sulphate of iron in the solution; nor by the exposure of such a solution freely to the air or to the light; differences of relative position of the electrodes to each other affect slightly both the amount of total loss of the anode per unit of current, and also the relative amount of such loss to the amount of gain of the cathode; the presence of a considerable quantity of persulphate of iron in the solution affects perceptibly the amount of deposited copper, but that of a moderate proportion of nitrate of copper in the solution had no conspicuous effect of the kind; the chemical corrosion of sheets of copper in pure acidulated solution of sulphate of copper was not directly proportionate to their amount of surface, but was relatively less upon the larger surface; the amount of copper deposited per unit of current did not vary much with the magnitude of the cathode or the density of the current; a very feeble thermo-electric current caused a cold copper anode to lose a little more, and a hot cathode to lose slightly less, than without the current; stirring the solution increased slightly the loss of weight of the anode per unit of current, and diminished to a small extent the gain of the cathode; stirring a pure acidulated solution of sulphate of copper increased the proportion of loss of weight of copper by ordinary chemical corrosion without an electric current from ·07 grain to ·17 grain, or from ·411 to 1·0, but in a less proportion if a current was entering the copper as a cathode; a considerable degree of density of current appears to be favourable to enabling a nearer approximation to be made to the true electro-chemical equivalent in the weight obtained of deposited copper.

Many of the experiments indicate, and the whole of them are consistent with the general inference, that in nearly all cases of electrolysis, the two forces, ordinary chemical and electro-chemical, coexist and operate independently at the same surfaces of liquid and metal; that ordinary chemical action, both of simple oxidation and of corrosion of both electrodes by free acid, takes place in all cases, and is a phenomenon essentially distinct from, and independent of, electro-chemical corrosion of the anode, and deposition upon the cathode. The two classes of phenomena, however, are coincident, and affect each other in various indirect and secondary ways.

In consequence of these two actions being essentially distinct and independent of each other, an electric current passing out of a piece of copper into an acid solution does not directly increase the rapidity of ordinary chemical corrosion of the metal, nor does a current entering from such a liquid into a copper cathode, protect in all cases that metal from such corrosion.

Some of the experiments show that stirring the liquid increases the ordinary chemical corrosion both of the anode and of the cathode, and therefore that the technical process of swaying to and fro by mechanical means, articles which are being plated in a depositing solution, tends to corrode them.

That temperature also greatly influences the chemical corrosion is proved by the numerical results. The higher the temperature the greater was the amount of chemical solution of the hot copper without current, and of the hot electrodes; and for equal rise of temperature, the increase of corrosion appeared to be

[1] Abstract of a paper read before the Birmingham Philosophical Society, January 26, 1882. By G. Gore, LL.D., F.R.S.